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(54) IMPROVEMENTS IN CIRCUIT BREAKERS

(71) We, LEGRAND SOCIETE ANONYME, a French Body Corporate, of 128 Avenue du Marechal de Lattre de Tassigny, Limoges, (Haute-Vienne), France, do hereby declare

the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to circuit breakers in general, and more particularly, although not exclusively, with circuit breakers which, being subject to stringent dimensional demands, are necessarily compact in volume.

Generally speaking, circuit breakers usually comprise, between two substantially parallel housing walls, a fixed contact, a moving contact, and an operating mechanism arranged to ensure the movement into and the maintenance into the engaged position of the moving contact, and the release into the disengaged or released position of the said moving contact in response to a release element such as a magnetic release.

Upon said release of the moving contact an arc is struck between the latter and the fixed contact, and it is important to ensure the rapid extinguishing of the arc in order to limit as far as possible the energy dissipated thereby between the contacts, said energy being capable of causing an irreversible deterioration of the contacts.

For this purpose it is known to utilise the field created by the passage of the arc and the force resulting therefrom to direct the arc towards an extinguishing chamber preferably comprising a plurality of deionisation plates.

It is found that many circuit breakers exhibit irregularities in functioning, which cause in spite of the extinguishing provided, the arc which is struck on the opening of the contacts to be prolonged for a longer time than is desirable.

Devices have already been expressly provided to improve extinguishing, independently of the associated release means, but this increases the number of parts in the circuit breaker, complicates its assembly, and increases its bulk and its cost price.

It is an object of the present invention to provide a circuit breaker which is substantially free from the said disadvantages and furthermore exhibits other advantages.

According to the invention there is provided a circuit breaker of the kind comprising between two substantially parallel main housing walls, a fixed contact, a moving contact and an operating mechanism arranged to ensure the movement into and the maintenance in the engaged position of the moving contact, and the release into the disengaged position of the said moving contact in response to a magnetic release element including a release winding with its axis parallel to the said walls, wherein there is provided a metal enclosure constituted by two lateral flanges parallel to the housing walls and two transverse plates which are substantially perpendicular to the said flanges, which extend between the flanges, and which are substantially perpendicular to the axis of the release winding, the lateral flanges ensuring the positioning of a part at least of the constituent elements of the control mechanism and having extensions forming, parallel to the housing walls, two blow-out cheeks which bound the closure and opening zone of said contacts.

Experience shows that the blow-out cheeks prolonging according to the invention the flanges of the metal enclosure advantageously guide or channel the magnetic field which is generated with the arc independently of the magnetic field which may possibly have caused the release of the circuit breaker, and reinforces the regularity of functioning of the latter to a considerable degree.

Furthermore the enclosure is advantageously free from any plate or flange in a direction which, parallel to the walls of the housing, is perpendicular to the moving coil of the magnetic release, which permits a considerable economy of space to be secured in that direction.

The said economy of space may advantageously be utilised, either for an overall reduction in the dimensions of the circuit breaker, or else for an arrangement of the operating mechanism thereof and/or of its extinction chamber.

Further the lateral flanges of the metal

enclosure advantageously ensure the positioning of a part at least of the constituent elements of the operating mechanism of the circuit breaker.

Consequently the whole of the said mechanism and of the magnetic release then constitute a unit which makes the assembly of the circuit breaker simpler and thus cheaper, therefore reducing its cost price.

The invention will now be described by way of example, with reference to the accompanying schematic drawings, in which:

Figure 1 is a view in elevation of a circuit breaker according to the invention in the engaged position, the housing of the circuit breaker being assumed to be half removed, and some of its elements being shown in section or partly removed;

Figure 2 is to a different scale, a partial view in perspective of the circuit breaker; and

Figure 3 is a view similar to Figure 2 illustrating an alternative embodiment.

Referring to Figures 1 and 2, the circuit breaker comprises a housing 10, comprising for example, two shells 10*a*, 10*b* abutting against each other in a common plane of contact. The housing therefore comprises two main parallel walls 11*a*, 11*b* partly illustrated in Figure 2.

The lower face of the housing 10 forms a shoe 12, Figure 1 arranged to be fixed upon an appropriate support. Between an upper face 13 and the shoe 12 the housing 10 contains successively an operating mechanism 14, a magnetic release element 15 and an arc extinguishing chamber 16 comprising a plurality of deionisation plates 17.

An extreme one of the deionisation plates 17 may in known manner be connected electrically to a fixed contact 18 which is electrically connected to a connection terminal 19 and which has a curved configuration permitting the insertion therein of a soft iron core 20.

Associated with the fixed contact 18 there is a moving contact 22 which is mounted slidingly and pivotingly on a pivot 23 housed in an inclined slot 24 formed in the housing 10. The contact 22 is urged into the released opening position thereof by a compression spring 25 supported, in the example illustrated in Figure 1, against the housing 10.

The moving contact 22 is electrically connected to a connection terminal 27 through successively a braid 28, the release winding 29 of the magnetic release element 15, a braid 30, and a bi-metal strip 31.

The above described arrangements are of known kind and will, therefore, not be described in detail hereinbelow.

The same applies to the operating mechanism, which in known manner comprises an operating handle articulated on a pivot 32 perpendicular to the walls 11*a*, 11*b* of the housing 10, it being understood that the teachings of the invention are not dependant on any particular kind of operating mechanism and may be included in any kind of circuit breaker.

It should be observed that the axis of the release winding 29 is parallel to the walls of the housing 10; here the term "walls of the housing" is understod to mean the main or longitudinal walls 11*a*, 11*b* thereof, that is to say, those perpendicular to which the pivot 23 of the moving contact 22 extends, also the pivot 32 of the operating mechanism 14, the said longitudinal walls 11*a*, 11*b* being thus distinguished from the transverse walls which close the housing 10 laterally along its edge.

The magnetic release unit 15 comprises, besides the winding 29 and a moving core 33 controlled by the latter, an enclosure 34 of magnetic metal which is adapted to ensure an appropriate shielding of the winding 29.

The metal enclosure is formed by two lateral flanges 34*a*, 34*b* which extend parallel to the housing walls 11*a*, 11*b*, and two parallel transverse plates 35, 36 which are substantially perpendicular to and extend between the flanges 34*a*, 34*b*, and which are substantially perpendicular to the axis of the release winding 29.

The lateral flanges 34*a*, 34*b* of the enclosure 34 are extended in the direction of the closure and opening zone Z of the contacts 18 and 22 so as to form two blow-out cheeks 38*a*, 38*b* which frame the closure and opening zone Z.

In the example illustrated, the transverse plates 35 and 36 comprise lugs 39 engaged in apertures 40 made in the lateral flanges 34*a*, 34*b* which ensures their maintenance in position.

Likewise in the example illustrated, the transverse plate 35 comprises an extension forming in itself one of the deionisation plates 42 of the extinguishing chamber 16, and the transverse plate 36 comprises an upward extension 43 pierced for example with an aperture 44 for the guiding of one of the constituent parts of the operating mechanism 14.

When the circuit breaker is released and open, whether it be following a manual operation by means of the operating mechanism 14, or of an automatic actuation of the magnetic release 15 or of the bi-metal strip 31, the moving contact 22 moves away from the fixed contact 18 and an arc is struck between the contacts, for example in the direction of the arrow 1 in Figure 2.

A magnetic blow-out field is likewise generated by virtue of the arc, independently of the field which may possibly have caused the release of the circuit breaker, said release possibly having been caused by the bi-metal strip 31, and said magnetic blow-out field

results in a force which normally tends to cause the arc to penetrate into the extinguishing chamber 16.

The cheeks 38*a*, 38*b* tend advantageously to channel the magnetic field which is generated upon the passage of the current, said field then developing perpendicularly into the cheeks, in the direction of the arrow H in Figure 2, which tends to reinforce the force of penetration of the arc into the extinguishing chamber 16, said force being perpendicular to the intensity 1 and to the field H, as shown schematically by the arrow F in Figure 2.

Experience shows that the said cheeks improve the regularity of development of the arc.

Experiments have also shown that it is thus possible to consider the elemination of the soft iron core 20, which is economical, and that for equal dimensions the limitation of intensity obtained with the circuit breaker according to the invention is superior to that obtained with the customary circuit breakers hitherto known.

Furthermore it will be observed that the metal enclosure 34 comprises no thickness of metal or enclosure surface in the direction D, Fig. 2, which whilst being perpendicular to the axis of the winding 29 of the magnetic release 15 is parallel to the flanges 34*a* and 34*b* and therefore to the housing walls 11*a*, 11*b*.

In enclosures of the usual kind, all the parts of which are perpendicular to the housing walls, there are necessarily two thicknesses of metal in the said direction D, and the arrangement according to the invention thus has the advantage of economising in its direction D the space required for the insertion of two thicknesses of metal.

This arrangement is the more advantageous since, for circuit breakers of compact size, any economy of space is of prime importance, which makes it possible for equal volume to have more space available for the positioning of the operating mechanism 14 and/or of the extinguishing chamber 16.

Furthermore, the lateral flanges 34*a*, 34*b* of the metal enclosure 34 ensure in themselves the positioning and the maintenance of the whole or part of the operating mechanism 14. A development of this possibility is illustrated by the embodiment illustrated in Figure 3.

In Figure 3, the lateral flange 34*b* carries at right angles a lug 48 provided to abut against the return spring 25 associated with the moving contact 22.

Also in Figure 3, the flanges 34*a* and 34*b* further comprise slots 49 for the passage with sliding of the pivoting axis of various elements of the operating mechanism 14 and of the moving contact 22, also bores 50 for the passage of those of the said axis which are simply pivoting, and more particularly of the pivoting axis 32.

The entire operating mechanism 14 and the magnetic release 15 therefore constitutes a unit capable of being introduced integrally into the housing 10, which facilitates the assembly of the circuit breaker.

Of course, the invention is not limited to the embodiments described and illustrated, but embraces such variations as fall within the scope of the appended claims.

More particularly, according to one variant of the enclosure illustrated in Figures 1 and 2, at least one of the transverse plates of the said closure circuit may be integral with the lateral flanges of the same, the said flanges and the said plate conjointly forming a generally U-shaped part.

WHAT WE CLAIM IS:—

1. A circuit breaker of the kind comprising between two substantially parallel main housing walls, a fixed contact, a moving contact and an operating mechanism arranged to ensure the movement into and the maintenance in the engaged position of the moving contact, and the release into the disengaged position of the said moving contact in response to a magnetic release element including a release winding with its axis parallel to the said walls, wherein there is provided a metal enclosure constituted by two lateral flanges parallel to the housing walls and two transverse plates which are substantially perpendicular to the said flanges, which extend between the flanges, and which are substantially perpendicular to the axis of the release winding, the lateral flanges ensuring the positioning of a part at least of the constituent elements of the control mechanism and having extensions forming, parallel to the housing walls, two blow-out cheeks which bound the closure and opening zone of said contacts.

2. A circuit breaker according to Claim 1, characterised in that the moving contact is urged into the disengaged position thereof by resilient means, and that either of the lateral flanges of the said enclosure comprises a lug for support of the resilient means.

3. A circuit breaker according to Claim 1 or Claim 2, characterised in that one at least of the transverse plates of the said enclosure comprises lugs for engagement into apertures made in said lateral flanges.

4. A circuit breaker according to any one of Claims 1 to 3, characterised in that at least one of the transverse plates of the said enclosure is integral with said lateral flanges and that the flanges and the said one plate conjointly form a generally U-shaped part.

5. A circuit breaker according to any one of Claims 1 to 4, including an arc extinguishing chamber containing de-ionisation plates wherein at least one of the transverse

plates of the said enclosure comprises an extension forming one of the de-ionisation plates of the arc extinguishing chamber.

6. A circuit breaker according to any one of Claims 1 to 5, characterised in that the said enclosure comprises at least one aperture for guiding one of the elements of the operating mechanism.

7. A circuit breaker according to any one of Claims 1 to 6, characterised in that the said enclosure is free from any thickness of metal in the direction which, whilst being perpendicular to the axis of the said release winding is parallel to the lateral flanges of the said enclosure.

8. A circuit breaker according to any one of Claims 1 to 7, wherein the said enclosure is made of magnetic metal.

9. A circuit breaker substantially as herein described with reference to and as illustrated in the accompanying drawings.

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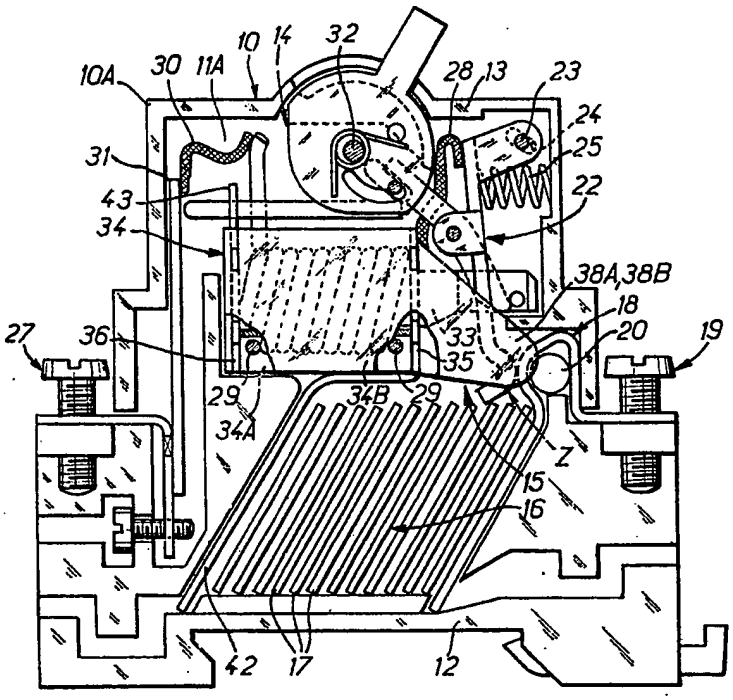
FIG.1



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Sheet 2

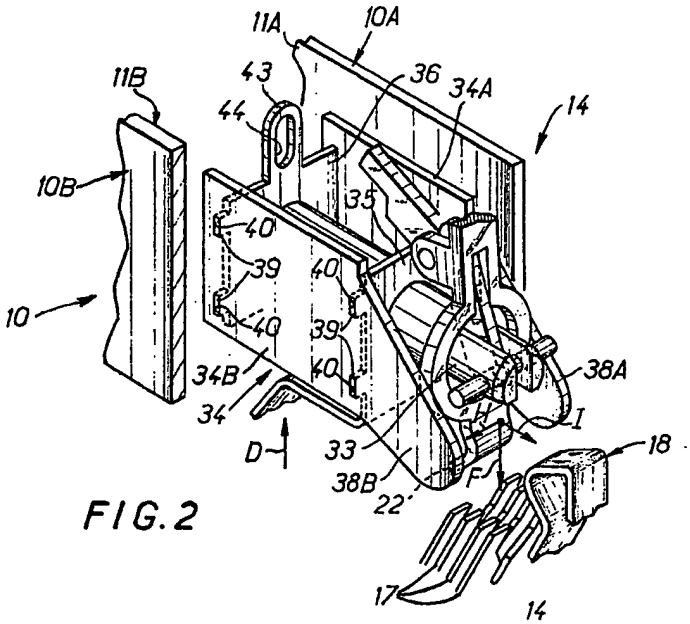

FIG.2

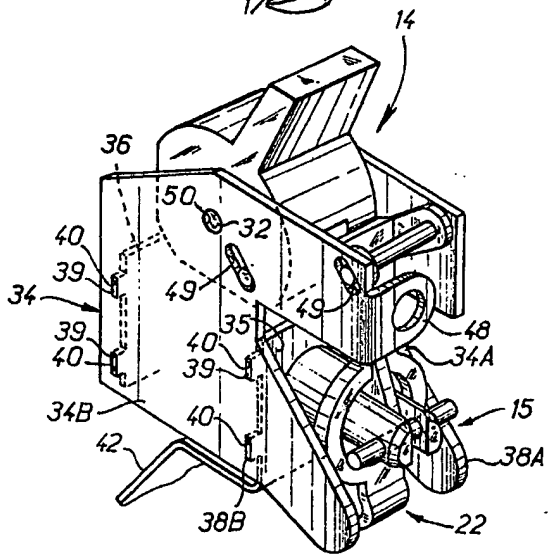

FIG.3